

CLAIMS:

- 1) A helmet mounted display unit that utilizes a digital micro-mirror device for the generation of images.
- 2) A light source that is capable of producing the three optical primary colours (blue, green and red or yellow) and is capable of switching between them rapidly.
- 3) An illumination module that consists of two light sources as described in claim 2 which are physically displaced in a plane defined by <sup>an</sup> the optical axis of the DMD and a vertical center line running from the top to the bottom of the DMD generating the images for the HMD. (I.e. if the DMD were oriented facing the viewer then the light sources would be displaced vertically about the center line of the DMD.)
- 4) A helmet mounted display unit as described in claim 1 that incorporates a single digital micro-mirror device and incorporates one or more light sources as described in claims 2,3 and pair of concave mirrors to focus and direct the light to the eyes of the viewer to produce two separate images.
- 5) A helmet mounted display unit as described in claim 1 that incorporates a single digital micro-mirror device and incorporates one or more light sources as described in claims 2,3 and a series of plain and concave mirrors to focus and direct the light to the eyes of the viewer to produce two separate images.
- 6) A helmet mounted display unit as described in claim 1 that incorporates a single digital micro-mirror device and incorporates one or more light sources as described in claims 2,3 and a series of plain mirrors and lenses to focus and direct the light to the eyes of the viewer to produce two separate images.

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- 7) A helmet mounted display unit as described in claim 1 that incorporates two digital micro-mirror devices and incorporates one or more light sources as described in claim 2 and a series of lenses to focus and direct the light to the eyes of the viewer to produce two separate images.
- 8) A helmet mounted display unit as described in claim 1 that incorporates a single digital micro-mirror device and incorporates one or more light sources as described in claims 2,3 and two off-axis focusing lenses to focus and direct the light to a pair of eyepieces and subsequently to the eyes of the viewer to produce two separate images.
- 9) A helmet mounted display as described in claim 1 that incorporates a lens or group of lenses placed directly in front of and on the same optical axis as the DMD to focus the light from the light sources as described in claims 2,3 to a pair of focus points. the said focused light is then reflected from either a single or pair of curved or plain mirrors onto a second set of concave mirrors and then into the viewers eyes.
- 10) A helmet mounted display as described in claim 1 that incorporates a lens or group of lenses placed directly in front of and on the same optical axis as the DMD to focus the light from the light sources as described in claims 2,3 to a pair of off-axis focusing lenses which in turn focus and direct the light to a pair of eyepieces and subsequently to the eyes of the viewer to produce two separate images.
- 11) A helmet mounted display as described in claim 1 that incorporates a lens or group of lenses placed directly in front of and on the same optical axis as the DMD to focus the light from the light sources as described in claims 2,3 to a pair of focus points. The said focused light is then reflected from either a single or pair of curved or plain mirrors onto a pair of off-axis focusing lenses which in turn focus and direct the light to a pair of eyepieces and subsequently to the eyes of the viewer to produce two separate images.

- 12) A helmet mounted display as described in claim 1 that incorporates a lens or group of lenses placed directly in front of and on the same optical axis as the DMD to focus the light from the light sources as described in claims 2,3 to a binocular arrangement of lenses or prism's which in turn focus and direct the light a pair of eyepieces and subsequently to the eyes of the viewer to produce two separate images.
- 13) A helmet mounted display as described in the claims 4-5 and claims 7-11 such that the optical components are substantially parallel but displaced vertically.
- 14) A helmet mounted display as described in the claims 4-12 such that the DMD/DMDs and or light sources are rotated 90 degrees to the optical axis of the viewer and optically coupled to the remainder of the optical apparatus by a partially silvered or plain mirror.
- 15) A helmet mounted display as described in claim 8 and claims 10-11 which incorporates a mechanism to adjust the spacing between the off axis focusing mirrors to achieve inter-ocular adjustment.
- 16) A light source as described in claims 2,3 that is comprised of a spinning drum of coloured filter material oriented along the axis of rotation such that the drum consists of at least three different sections such that light passing outwards from the inside of the drum will be filtered into the three optical primary colours (blue, green and red or yellow) and a white light source that is contained within the drum to provide said light, a collimating lens assembly, an optional diffuser and a form of motive force such as an electric motor to provide and regulate the rotation of said drum.
- 17) A light source comprised of two spinning drums as described in claim 16 that share a common axis of rotation but are rotated substantially 180 degrees out of phase with each other and consist of at least 180 degrees of substantially opaque material in

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addition to the transparent filter material such that only one of the two drums will be passing light through to the collimating lens at any one time.

- 18) A light source as described in claims 2,3 that is comprised of a group of 1 or more light emitting diodes, or other light sources that have both a relatively fast response time and can produce light with colours that are substantially equivalent to the three optical primary colours (blue, green and red or yellow), which are placed in a cluster some distance behind a diffuser and optional collimating lens.
- 19) A light source as described in claims 2,3 that is comprised of a group of 1 or more light emitting diodes, or other light sources that have both a relatively fast response time and can produce light with colours that are substantially equivalent to the three optical primary colours (blue, green and red or yellow), and a series of partially silvered mirrors and plain mirrors or a series dichroic mirrors and plain mirrors and a diffuser and optional collimating lens.
- 20) A light source as described in claims 2,3 that is comprised of a source of white light, three colour filters capable of filtering white light into the three optical primary colours (blue, green and red or yellow), three separate fast response light valves such as ferro-electric LCD shutters which are placed in the optical path of each of the said filters and a series of partially silvered mirrors and plain mirrors or a series dichroic mirrors and plain mirrors and a diffuser and optional collimating lens.
- 21) An HMD as described in claim 1 and claims 4-15 in which the DMD has a plurality of digital micro-mirror arrays in a single chip such that the central vision region (fovea) of the viewer's eye substantially covers the central digital micro-mirror array in the group with the outer micro-mirror arrays providing image generation for the viewer's peripheral vision.

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22) An HMD as described in claim 1 and claims 4-15 in which an optical distortion is intentionally inserted into the optical path to generate pin cushion distortion in the resultant image such that the pixel density is higher in the center of the image than the outside

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